THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today
(1) was not written for publication in a law journal and
(2) is not binding precedent of the Board.

Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

_____

Ex parte YAU-KAE SHELL and GARY HONG

_____

Appeal No. 1997-3916
Application No. 08/429,650

_____

ON BRIEF

_____

Before HAIRSTON, BARRETT, and LEVY, ***Administrative Patent Judges***.

LEVY, ***Administrative Patent Judge***.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection[1] of claims 25-30, which are all of the claims pending in this application.

[1] An amendment was filed subsequent to the final rejection (Paper no. 14, filed July 1, 1996). The examiner approved entry of the amendment in a subsequent advisory action (Paper no. 15, mailed July 15, 1996).

BACKGROUND

The appellants' invention relates to a field effect transistor with a self-aligned anti-punchthrough implant channel. An understanding of the invention can be derived from a reading of exemplary claim 25, which is reproduced as follows:

> 25. A field effect transistor having an aligned anti-punchthrough buried implant channel, comprising:
>
> a semiconductor substrate having a principle surface with device areas and field oxide areas thereon;
>
> a gate oxide layer on said devices areas composed of thermal oxidation;
>
> a patterned polysilicon layer forming gate electrodes on said gate oxide layers;
>
> a buried layer of implanted boron ions in said substrate, below and centered on said gate electrode and forming a buried anti-punchthrough implant channel which is narrower than said gate electrode;
>
> lightly doped drain (LDD) regions adjacent to said gate electrode;
>
> sidewall spacers on sidewalls of said gate electrode composed of silicon oxide;
>
> source/drain regions in said device area, formed by implantation and thereby having a field effect transistor with said buried anti-punchthrough implant channels under and centered on said gate electrode.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Kubo	5,463,241	Oct. 31, 1995
Chen	5,274,261	Dec. 28, 1993
Miyamoto et al (Miyamoto)	5,359,221	Oct. 25, 1994
Sanchez	5,097,301	Mar. 17, 1992
Makino	JP 02-1173	Jan. 05, 1990

Claims 25-30 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

Claims 25 and 27-30 stand rejected under 35 U.S.C. §103 as unpatentable over Kubo in view of Chen.

Claim 26 stands rejected under 35 U.S.C. §103 as unpatentable over Kubo in view of Chen and further in view of Sanchez.

Claims 25 and 27-30 stand rejected under 35 U.S.C. §103 as unpatentable over Miyamoto in view of Makino[2].

Claim 26 stands rejected under 35 U.S.C. §103 as unpatentable over Miyamoto in view of Makino and further in view of Sanchez.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellants regarding the above-noted rejections, we make reference to the examiner's answer (Paper No. 20, mailed May 9, 1997) and the final rejection (Paper No. 9, mailed March 27, 1996) for the examiner's complete

[2] We rely on and refer to the English translation of record of this document.

reasoning in support of the rejections, and to the appellants' brief (Paper No.19, filed November 29, 1996) for the appellants' arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by the appellants and the examiner. As a consequence of our review, we make the determinations which follow.

Appellants submit (brief, page 7) that "[f]or each of the grounds of rejection contested by appellant [sic: appellants] in this appeal, claims 25-30 may be treated as a group. Claim 25, the sole independent claim pending, may be taken as representative for the issues on appeal."[3]

Turning first to the rejection of claim 25 under 35 U.S.C. §112, second paragraph, we note at the outset that the examiner's statement of the rejection (final rejection, page 2), referred to by the examiner in the answer (page 3), is inconsistent with the claim language presently before us on appeal, as claim 25 was amended subsequent to the final rejection (amendment filed July 1, 1996). However, as the examiner has presented arguments commensurate with the language of appealed claim 25 in the remarks section of the answer, we will construe the examiner's remarks (answer, pages 4 and 5) as both the examiner's statement of the rejection as well as the examiner's response to appellants' arguments in the brief. The

[3] We note that the arguments found in the brief are limited to claim 25.

examiner's apparent position (answer, pages 4 and 5) is that the alignment relationship set forth in the preamble of claim 25 is not clearly defined and

contradicts the language found in the body of the claim. The examiner states (answer, pages 4 and 5) that "opening a portion through the gate electrode does not mean that the buried layer formed by implanting impurities through that opening is aligned with the gate, since there is no common line or boundary between the gate and the buried layer." In the examiner's opinion, (answer, page 4) "the term 'aligned' has a specific meaning, which is to have boundaries in line." Appellants assert (brief, page 9) that the claim language is consistent with the teachings of the specification, and that the examiner's very narrow definition of the term "aligned" is improper. We agree. As pointed out by our reviewing court, "[T]he name of the game is the claim." ***In re Hiniker Co.***, 150 F.3d 1362, 1369, 47 USPQ2d 1523, 1529 (Fed. Cir. 1998). Claims will be given their broadest reasonable interpretation consistent with the specification, ***In re Etter***, 756 F.2d 852, 858, 225 USPQ 1, 5 (Fed. Cir. 1985). The claim language in question is as follows:

> A field effect transistor having an aligned anti-punchthrough buried implant channel, comprising. . . a buried layer of implanted boron ions in said substrate, below and centered on said gate electrode and forming a buried anti-punchthrough implant channel which is narrower than said gate electrode

As to the issue of whether the buried region can be both narrower[4] than the gate electrode and aligned with the gate electrode, we are not in agreement with the examiner's statement (answer, page 5) that the buried layer and gate electrode are not aligned because a common line or boundary between the gate electrode and the buried layer has not been defined.

The specification (page 6, lines 3-6) states that "the invention provides a new field effect transistor structure having a buried anti-punchthrough implant region or channel aligned to and under the gate electrode of the FET." We therefore find that the term "aligned" refers to the buried layer being centered and below the gate electrode, with the buried layer being narrower than the gate electrode. We are in agreement with appellants (brief, page 9) that the examiner's interpretation of the term "aligned" is inconsistent with the term as defined in the specification.

We find no teaching or suggestion in the specification to indicate that the outer edges of the buried layer are to be in a line with the outer edges of the gate electrode in order for the buried layer and the gate electrode to be aligned with each other. Nor is there evidence of record that the term "aligned" has a specific meaning in the semiconductor art that would preclude the appellants from using the term "aligned" to refer to the buried layer being narrower than the gate electrode as well as aligned with the gate

[4] We note that the term "narrower" does not appear in the originally filed disclosure. However, we find basis for use of the term "narrower" in the specification (pages 14 and 15) where it is stated that "the sidewalls 30 further narrows the self-aligned opening 34 over the gate electrode area that will be later used for implanting the buried anti-punchthrough implant channel in the substrate under the gate electrode 22" and "The sidewall spacers also reduce the width of the anti-punchthrough implant channel" which we find will result in the buried layer being narrower than the gate electrode.

electrode. We therefore find that the term "aligned" in claim 25 does particularly point out and distinctly claim the subject matter which appellants regard as their invention. Accordingly, the rejection of claims 25-30 under 35 U.S.C. §112, second paragraph, is reversed.

We now turn to the rejection of claim 25 under 35 U.S.C. §103 as unpatentable over Kubo in view of Chen.

We find that the examiner has failed to set forth a ***prima facie*** case of obviousness in this rejection. It is the burden of the examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications contained in such teachings or suggestions. ***See In re Sernaker***, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983).

The sole issue presented to us is whether Kubo or Chen teach a buried anti-punchthrough implant channel or region that is narrower than the gate electrode. The examiner states (final rejection, page 4) that Kubo shows a buried layer (1C) which forms a buried anti-punchthrough implant channel which is narrower than the gate electrode. The examiner's position (answer page 5, is that:

> the Kubo reference does indeed show in figs. (1,10) that a punch rough [sic: punchthrough] region can be formed narrower than the gate electrode and shows in other figures that the size of the punch through regions can vary in size see figs. 93-9), thus one of ordinary skill in the art realizes from the figures alone that the size of the punch through region can indeed vary in size.

Appellants assert (brief, page 10), that there is no description or teaching in the reference of an anti-punchthrough region narrower than the gate electrode. Appellants argue (brief, page 11) that:

> On reviewing the Kubo patent, however, one of ordinary skill in the art finds no clear teachings regarding the size of an anti-punchthrough region. Rather, one of ordinary skill finds a jumble of poorly drawn, schematic figures that convey no clear teachings as to the size of an anti-punchthrough region. One of ordinary skill, upon finding no clear teachings related to the size of buried anti-punchthrough regions in the figures of the Kubo patent could continue to the text of the Kubo patent and find a complete lack of teachings as to the relative size of the anti-punchthrough region and the gate in the specification of the Kubo patent.

Thus, the issue before us is whether Kubo teaches or suggests forming a buried anti-punchthrough implant channel that is narrower than the gate electrode. Based upon the opposing arguments found in the brief and the answer, we find this disputed issue of fact to be close; but on the balance, we find that Kubo does not teach or suggest forming a buried anti-punchthrough layer that is narrower than the gate electrode, for the following reasons.

From our review of Kubo, we agree with the examiner that figures 1 and 10 of Kubo, as well as figures 2A, 2B, 12A-12D and 13-15 appear to illustrate buried layer (1C) to be narrower than the electrode (3); whereas figures 3-9, as well as figure 11 appear to illustrate the buried layer (1C) to be wider than electrode (3). However, we are in agreement with appellants (brief, pages 11 and 12) that the figures of Kubo are too variable and schematic in nature, and provide no clear teaching as to the size of the buried anti-punchthrough implant channel. For example, as illustrated in the drawings of Kubo, measuring the size of various elements found in the drawings, we find that in figure 1, buried layer (1C) is 10 mm

wide. The same element (1C) in figure 3 is 14 mm wide. The same element (1C) in figure 4 is 18 mm wide and in figure 7, element (1C) is 20 mm wide. Additionally, in figure 7, the height of element (1C) is 4.5 mm. In figure 8, the same element is 6 mm in height. Moreover, in figure 1, drain wiring electrode (7) is 17.5 mm wide, whereas source wiring electrode (8) is illustrated as 20 mm wide. In figure 3, both the source drain wiring electrode (7) and the source wiring electrode 8 are 17.5 mm wide. IN contrast, in figure 10, the drain wiring electrode (7)

is 19 mm wide whereas the source wiring electrode (8) is 21 mm wide. We find no reference in the specification of Kubo to indicate that any of these elements are intended to be of different sizes.

With respect to the issues of whether the different sizes of buried elements (1C) of Kubo suggests making the buried elements (1C) narrower than the gate electrode, from our analysis of Kubo, we find that in view of Kubo's illustrations depicting different elements to be different sizes; along with the fact that Kubo does not recognize the problem of preventing punchthrough by reducing the size of the buried implant that Kubo does not suggest forming a buried layer (1C) narrower than the gate electrode (3). We are in agreement with appellants (brief, pages 12 and 13) that in reviewing Kubo's teachings regarding the formation of the buried layer (1C) that:

> Nowhere in the Kubo patent is there further description of the photoresist mask used to define buried region 1C. Thus, there is too little information in the specification of the Kubo patent to constitute a teaching as to the relative size of the anti-punchthrough regions of the Kubo patent.

Accordingly, we would have to speculate in order to arrive at a conclusion that Kubo teaches or suggests making the buried anti-punchthrough implant channel narrower than the gate electrode, which on balance, the evidence of record does not support. As Chen does not overcome the deficiencies of Kubo, the rejection of claim 25 under 354 U.S.C. § 103 is reversed.

As claims 27-30 depend from claim 25, the rejection of claims 27-30 as unpatentable over Kubo in view of Chen is reversed.

As claim 26 depends from claim 25 and Sanchez does not overcome the deficiencies of Kubo and Chen, the rejection of claim 26 under 35 35 U.S.C. §103 as unpatentable over Kubo in view of Chen and further in view of Sanchez is reversed.

Turning now to the rejection of claim 25 under 35 U.S.C. §103 as unpatentable over Miyamoto in view of Makino, the point of contention between the examiner and the appellants is whether Miyamoto teaches or suggests a buried anti-punchthrough implant channel which is narrower than the gate electrode. The examiner asserts that Miyamoto teaches (final rejection, page 6) the region (6) (i.e., a buried anti-punchthrough region) is narrower than the gate electrode (3) as shown by the distance Lp.

Appellants assert (brief, page 15) than in Miyamoto, the buried region (6) extends under the entire active device, spanning far on either side of gate electrode (3), and that the subsequent implantation of still higher doses of P-type impurities to areas peripheral to gate electrode (3) does not make the region (6) any narrower.

The examiner's position (answer page 7) is that the final structure of the Miyamoto device has region (6) formed narrower and only under the gate electrode (3), and that regions (6) and (7) in effect form two different regions as evidenced by the fact that the two regions (6) and (7) have different concentration levels. Claim 25 recites "a buried layer . . . forming a buried anti-punchthrough implant channel". We find that in Miyamoto (figure 12) high concentration region (6)

is formed in the whole channel region (col. 4, lines 62-68) and that after forming the gate electrode (3) ion implantation is carried out using the gate electrode (3) as a mask in the forming of the high concentration region (7). Miyamoto states (col. 5, lines 1-3) that "[a]ccording to this method, the high concentration region 7 can be formed in self aligned from the edge of the gate electrode 3 in definite penetrating depth irrespective of the gate length." and that high concentration region (7) enters by the definite distance Lp from the channel edge (figure 1 and col. 6, lines 55-57).

We agree with the examiner that in the final product, the high concentration regions (6) and (7) form different regions due to their different concentrations levels. However, we find that the high concentration regions (6)(7) function together to suppress punchthrough (col.. 7, lines 3-6). Since high concentration regions (6) and (7) cooperate together to suppress punchthrough, and extend beyond the gate electrode (3), we find that the claim language of "a buried layer of implanted boron ions . . . forming a

buried anti-punchthrough implant channel which is narrower than the gate electrode" is not met by Miyamoto. We are not persuaded by the examiner's assertion (answer, page 7) that claim 25 does not preclude the formation of other regions abutting anti-punchthrough region. We agree that the claim dos not preclude the formation of other regions abutting the anti-punchthrough region. However, we find that the anti-punchthrough region is high concentration layers (6) and (7). We do not consider Miyamoto to fairly suggest that the buried layer which forms the anti-punchthrough implant channel to be narrower than the gate electrode.

The examiner relies upon Makino to provide the deficiencies in Miyamoto. While the examiner only relies upon Makino for a teaching of an LDD structure as part of the source/drain region, we find Makino to be closer to appellants claimed invention than the other references relied upon by the examiner. Makino recognizes (figure 4, pages 5 and 18) that in the prior art, an attempt was made to prevent punchthrough current in an FET by providing a high concentration layer (104) which extends across the active area. While punchthrough current was reduced, the junction breakdown strength declined (page 6). The purpose of Makino's invention (page 6) was to achieve higher performance by depressing a punchthrough current without increasing the capacitance nor reducing the junction breakdown strength. Makino's invention is to provide a high concentration region (4) formed of a buried layer of implanted boron ions (figure 2 and page 8) to prevent punchthrough. Makino states (page 9) that the electrode (7) is

exactly above the high concentration regions (4) (page 11) and that the high concentration region (4) is at the mid position between the source region and the drain region (page 11). However, Makino does not disclose the high concentration layer (4) to be narrower than the gate electrode (7). Accordingly, Makino does not overcome the deficiencies of Miyamoto. We therefore will reverse the rejection of claim 25 under 35 U.S.C. § 103 as unpatentable over Miyamoto in view of Makino. As claims 27-30 depend from claim 25, the rejection of claims 27-30 as unpatentable over Miyamoto in view of Makino is reversed.

Turning now to the rejection of claim 26 as unpatentable over Miyamoto in view of Makino and further in view of Sanchez, as Sanchez does not overcome the deficiencies of Miyamoto and Makino, the rejection of claim 26 under 35 U.S.C. §103 is reversed.

CONCLUSION

To summarize, the decision of the examiner to reject claims 25-30 under 35 U.S.C. §103 § 112, second paragraph is reversed. The decision of the examiner to reject claims 25-30 under 35 U.S.C. §103 is reversed.

REVERSED

KENNETH W. HAIRSTON)
Administrative Patent Judge)

	)
	)
	)
	) BOARD OF PATENT
LEE E. BARRETT	) APPEALS
Administrative Patent Judge	) AND
	) INTERFERENCES
	)
	)
	)
STUART S. LEVY	)
Administrative Patent Judge	)

ssl/vsh

RABIN, CHAMPAGNE & LYNT, P.C.
1725 K STREET, NW
SUITE 111
WASHINGTON , DC 20006